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10/717,487	11/21/2003	Tokihiro Nishihara	025720-00017	7624

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EXAMINER

SUMMONS, BARBARA

ART UNIT PAPER NUMBER

2817

DATE MAILED: 08/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/717,487

Applicant(s)

NISHIHARA ET AL.

Examiner

Barbara Summons

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 June 2005.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is* closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 19 and 20 is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Withdrawn Claim Rejections - 35 USC §§ 102 and 103

1. Applicants' amendment and remarks received June 8, 2005 have overcome all prior rejections, and therefore, all of the prior rejections are withdrawn.

New Claim Objections

2. Claims 19 and 20 are objected to because of the following informalities:

In claim 19, on the next to last line thereof, the comma after "film" should be deleted.

Claim 20 is poorly worded since something cannot be "connected in parallel more than" something else. In light of the specification, at least especially Fig. 16, the Examiner believes the intended meaning of the last paragraph of claim 20 to be:

- - the series-arm resonators at the first stage on the signal input side including more single-terminal pair piezoelectric thin-film resonators connected in parallel than in each of the other series-arm resonators - -.

The claim needs to be reworded either as indicated above, or in some other manner that clarifies that it is the number of thin-film resonators connected in parallel that is "more" in the first series-arm stage than in the other series-arms. If this is not the intended meaning of the claim, then a clearly worded claim and explanation is required. Appropriate correction is required.

New Grounds of Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-4 and 7-9 are rejected under 35 U.S.C. § 102(b) as being anticipated by Lakin U.S. 5,942,958 (of record).

Regarding claims 1 and 8, Figs. 3A and 3B of Lakin disclose a ladder filter element comprising: a plurality of resonators in series arms 31, 33, 35, 37 and 39 and parallel arms 32, 34, 36 and 38 in a ladder circuit, and with a single piezoelectric thin film layer common to the plurality of resonators (see e.g. col. 4, lines 1-4 and col. 1, lines 24-36); and wherein at least one of the series arm resonators (e.g. arm 33) includes a plurality of four single-terminal pair piezoelectric thin film resonators (TFRs) X33AA/X33AB and X33BA/X33BB connected in parallel between the nodes connecting to parallel arms 32 and 34.

Regarding claims 2-4, at least the parallel arm resonator 32 at the first stage on the signal input side includes a plurality of two TFRs X32A and X32B connected in parallel between the node between series arms 31 and 33 and ground. Regarding claims 7 and 8, see col. 4, lines 60-64 and col. 5, lines 39-40, respectively.

New Grounds of Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1-4, 7, 8, 10 and 11 rejected under 35 U.S.C. § 103(a) as being unpatentable over Shibata et al. U.S. 6,556,103 ('103) in view of Tikka et al. U.S. 6,741,145 (of record).

Regarding claims 1-4 and 8, Figs. 33, 35 and 37 of Shibata US '103 disclose a ladder filter formed with TFRs wherein each of the series arm and parallel arm resonators 10 in Fig. 37 is replaced with two TFRs connected in parallel as shown in Figs. 33 and 35 (see col. 15, lines 3-5). Regarding claim 7, see the resonators connected in parallel of the other third embodiment shown in Fig. 24 having radius r (see also col. 12, lines 32-34). Regarding claim 10, see col. 12, lines 12-13 and 22-31. Regarding claim 11, see layer 214 that is formed on all of the resonators to provide a temperature coefficient of frequency of zero (see e.g. col. 14, lines 53-67).

However, US '103, while showing that the two resonators connected in parallel share a common piezoelectric layer (see Shibata's claim 19), does not explicitly show that all of the resonators in the ladder filter of Fig. 37 share the piezoelectric layer.

Tikka '145 discloses that forming TFRs with a patterned piezoelectric layer (see Fig. 13a) or an unpatterned piezoelectric layer (Fig. 13b) are art recognized alternatives.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter element of Shibata US '103 (Figs. 33, 35 and 37), if even necessary, such that all of series and parallel arm resonators would have had a common piezoelectric thin film layer, because Shibata US '103 is silent as to the formation of the piezoelectric layer for the ladder filter of Fig. 37, thereby suggesting to one of ordinary skill that any well known method of forming the piezoelectric layer, including not patterning it and using vias for connections, as suggested by Tikka '145 (Fig. 13b), would have been usable therewith, and because even if the piezoelectric layer of Shibata US '103 were patterned, forming it common to all of the resonators by not patterning it, would have been merely an art recognized alternative as suggested by Tikka '145 (see Fig. 13a vs. Fig. 13b).

7. Claim 10 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Lakin U.S. 5,942,958 taken alone.

Lakin discloses the invention as discussed above, and including a substrate (see e.g. col. 4, lines 4-6).

However, Lakin is silent as to the materials of the substrate, electrodes and piezoelectric layer.

The Examiner takes Official notice that all of the materials listed would have been extremely well known in the piezoelectric TFR art as evidenced by the other prior art of record (see e.g. Shibata et al. U.S. 6,556,103 col. 5, lines 51-63; Barber et al. U.S. 6,486,751 col. 3, lines 25 and 58 and col. 4, lines 4-5; etc.).

Consequently, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter element of Lakin (Figs. 3A and 3B), if even necessary, such that the filter element would have been made from the recited materials, because Lakin is silent as to the materials used, thereby suggesting to one of ordinary skill that any well known materials, such as the extremely well known materials listed, as evidenced by other art of record, would have been usable therewith.

8. Claims 5 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Lakin U.S. 5,942,958 (of record) in view of Satoh et al. U.S. 5,631,612 (of record).

Lakin and Shibata US '103 each discloses the invention as discussed above, except for disclosing the admittance of the series arm or parallel arm having the multiple resonators connected in parallel being the same as the admittance in another of the series arms or parallel arms.

Satoh et al. discloses that when designing ladder filters the admittance Y of multiple parallel arms are made to be the same (see Figs. 63A-63C), wherein the impedance Z of the series arms is related to admittance such that the admittance of multiple parallel arms are also the same, such that when resonators are split or combined the total admittance of the parallel arm remains the same (see e.g. Figs. 62A and 62B).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Lakin (Figs. 3A and 3B), if even necessary, such that the admittance of two series arms would have been equal or of two parallel arms would have been equal, because such an obvious modification

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would have provided good filter characteristics with image impedance matching between ladder filter stages as would have been known by one of ordinary skill and as suggested by Satoh et al. (see e.g. Figs. 62 and 63 and col. 20, lines 22-29). It should be noted that although Satoh et al. speaks in terms of surface acoustic wave (SAW) resonators, SAW resonators and thin film bulk acoustic resonators (FBARs) are electrical equivalents as would have been known by one of ordinary skill in the art (see other art of record as evidence, Wadaka).

9. Claims 5 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Shibata '103/Tikka '145 as applied to claim 1 above, and further in view of Satoh et al. U.S. 5,631,612 (of record).

The Shibata '103/Tikka '145 combination discloses the invention as discussed above, except for the recited admittance.

Satoh et al. teaches designing resonators in ladder filters to have such admittance relationships as discussed in the immediately preceding rejection.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the Shibata '103/Tikka '145 combination, if even necessary, such that the admittance of two series arms would have been equal or of two parallel arms would have been equal, for the same reasons given in the immediately preceding rejection.

10. Claim 11 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Lakin U.S. 5,942,958 (of record) in view of Tikka et al. U.S. 6,407,649 (of record).

Lakin discloses the invention as discussed above, except for explicitly disclosing a film of SiO₂ on the upper electrode of the parallel resonators.

Tikka '649 discloses that it is extremely well known in the thin film piezoelectric resonator art that in ladder filters the parallel resonators have a different resonant frequency from the series resonators, the different frequency being provided by mass loading the parallel resonators by providing a dielectric film of SiO₂ on the upper electrodes thereof (see Fig. 7 and col. 3, lines 62-65 and col. 4, lines 47-49 and 60-63).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Lakin, if even necessary, such that the parallel arm resonators would have had a film of SiO₂ on their top electrodes, because such an obvious modification would have merely been a well known manner of providing the different resonant frequencies between the series and parallel resonators in a thin film piezoelectric resonator ladder filter, as would have been known by one of ordinary skill and as explicitly suggested by Tikka et al. '649 (ibid.).

11. Claims 12-18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Lakin U.S. 5,942,958 (of record) in view of Bradley et al. U.S. 6,262,637 (of record).

Lakin discloses the invention as discussed above, except for explicitly disclosing the filters being housed in a package for use as a transmitting/receiving filter in a high-frequency duplexer with amplifiers.

Bradley et al. discloses that it would have been extremely well known in the art to provide thin film piezoelectric resonator filters in packages (not shown see col. 11, lines

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46-59) as the transmitting and receiving filters in duplexers utilizing a power amplifier in the transmitting branch and a low noise amplifier in the receiving branch (see Fig. 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Lakin by having provided it in a package and used it as the transmitting and receiving filters in a duplexer with amplifiers, because such an obvious modification as packaging is explicitly suggested by Bradley et al. (see col. 11, lines 46-59) and would have provided the advantageous benefits of protection from environmental factors as, as would have been known by one of ordinary skill, and using the filter in duplexers with amplifiers would have merely been an extremely well known intended use of thin film piezoelectric resonator filters as suggested by the exemplary teaching thereof by Bradley et al. (see Fig. 1).

12. Claims 12-18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Shibata '103/Tikka '145 as applied to claim 1 above, and further in view of Bradley et al. U.S. 6,262,637 (of record).

The Shibata '103/Tikka '145 combination discloses the invention as discussed above, except for explicitly disclosing the filters being housed in a package for use as a transmitting/receiving filter in a high-frequency duplexer with amplifiers.

Bradley et al. discloses the packaging of TFR filters and their use in duplexers, as discussed in the immediately preceding rejection.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of the Shibata '103/Tikka '145

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combination by having provided it in a package and used it as the transmitting and receiving filters in a duplexer with amplifiers for the same reasons given in the immediately preceding rejection.

Allowable Subject Matter

13. New Claims 19 and 20 are allowable over the prior art of record, but the Examiner reserves the right to withdraw the allowability of claim 20, if the meaning of the claim is different from that specified in paragraph 2 above.

14. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record does not disclose or fairly suggest a filter element with "only the series and/or parallel arm resonators at the first stage...including a plurality of ...thin-film[,] resonators connected in parallel" (see claim 19, the last three lines thereof), or with the "series arm resonators at the first stage..." having more thin-film resonators than in each of the other series arm resonators (see claim 20 and para. 2 above).

Response to Arguments

15. Applicant's arguments with respect to the claims and the Shibata JP reference have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ella U.S. 5,910,756 provides further evidence that it is known to form a TFR ladder filter with a single piezoelectric layer and connect the resonators with vias (see Figs. 9f-9h).

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Barbara Summons whose telephone number is (571) 272-1771. The examiner can normally be reached on M-Th, M-Fr.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bob Pascal can be reached on (571) 271-1769. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

bs
August 22, 2005

A handwritten signature in cursive script that reads "Barbara Summons".

**BARBARA SUMMONS
PRIMARY EXAMINER**